Status of Gypsy Moth Populations at Naval Observatory, Naval Surface Weapons Center (White Oak), David W. Taylor Naval Ship Research and Development Center (Carderock), and U.S. Naval Reservation (Annapolis)

Prepared by

Bradley P. Onken
Forester

and

Noel F. Schneeberger
Entomologist

USDA Forest Service
Forest Pest Management
Morgantown, WV 26505

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INTRODUCTION

On September 17 and November 23-24, 1987, USDA Forest Service personnel conducted gypsy moth egg mass surveys at the Naval Observatory, Naval Surface Weapons Center (White Oak), D.W. Taylor Naval Ship Research and Development Center (Carderock), and the U.S. Naval Reservation (Annapolis). The purpose of these surveys was to determine the status of gypsy moth populations on selected Navy activities within the Chesapeake Division and assist in determining if intervention tactics are necessary in 1988.

METHODS

Gypsy moth survey plots were randomly selected based on available host trees (oaks), size of sample areas, uniformity between egg mass counts, areas of concern to facility personnel, and available time. At each sample point, either a 1/40th acre fixed-radius plot or a 5-minute walk was conducted.

The fixed-radius plots (radius 18.6 feet) consisted of a tally of all the newly laid (1987) egg masses observed on the overstory trees, understory vegetation, ground litter and duff. The total egg masses observed for each plot was then multiplied by 40 to determine egg masses per acre using the following equation:

$$Y = 40X$$

where,

Y = egg masses per acre
X = number of egg masses observed in the plot

The 5-minute walk method consisted of 2 observers casually walking in the same direction from the same starting point within the survey area for a period of 5 minutes. The number of new egg masses observed were then averaged and the number of egg masses per acre determined as follows:

$$Y = 20.56X + 14.58 \text{ } ^{1/}$$

where,

Y = egg masses per acre
X = average number of egg masses observed during the 5-minute walk

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1/ Eggen, D.A., and L.P. Abrahamson. 1983. Estimating Gypsy Moth Egg Mass Densities. State Univ. of NY, Coll. of Env. Sci. and Forestry, School of Forestry. Misc. Publ. No. 1 (ESF 80-002). 30p.

RESULTS

Tables 1-4 present the egg mass survey data for each of the four Navy activities. Figures 1-4 show the general locations of the survey points

Naval Observatory

Table 1 presents the average egg mass counts by the forest compartment number at the Naval Observatory. Figure 1 is a forest compartment map and shows the survey area. A total of 12 survey plots was established at the Naval Observatory. Egg mass densities throughout the Naval Observatory averaged 207 egg masses per acre (Range = 0-1240). The heaviest concentration of egg masses was located in Forest Compartment 3 where counts ranged from 440-1240 and averaged 773 egg masses/acre. The average egg mass density in the remaining compartments ranged from 0 (Compartment #2) to 145 egg masses per acre (Compartment #4).

Naval Surface Weapons Center (White Oak)

A total of 12 survey plots was established at the Naval Surface Weapons Center at White Oak. Table 2 presents the egg mass survey results for each survey point, and Figure 2 shows the location of the survey points. Area-wide, the egg mass counts ranged from 0-1955 and averaged 390 egg masses per acre. The highest counts were found on the western end of the site as represented by plots 1, 11, and 12. These averaged 505, 1655, and 1955 egg masses/acre, respectively.

David W. Taylor Naval Ship Research and Development Center (Carderock)

A total of 9 survey plots was established at David W. Taylor Naval Ship Research and Development Center (Carderock). Table 3 lists the egg mass survey results at each survey point, and Figure 3 shows the general location of each survey point. Site-wide egg mass densities ranged from 0-815 and averaged 196 egg masses per acre. The highest counts were found at plot numbers 6, 8, and 9, where egg mass densities were 240, 255, and 815 egg masses per acre, respectively.

U.S. Naval Reservation (Annapolis)

A total of 10 survey points was established on the U.S. Naval Reservation at Annapolis. Table 4 lists the results of the egg mass survey for each survey point, and Figure 4 shows the approximate location of the survey points. Egg mass densities ranged from 0-160 and averaged 28 egg masses per acre. Sixteen egg masses were observed on a single chestnut oak in the parking lot of the Post Exchange. This tree was not included in any of the survey plot results.

DISCUSSION

The gypsy moth is subject to physical and biological factors that help to regulate the population. The availability and suitability of food, site conditions, incidence of natural control factors (predators and parasites), inter- and intra-specific competition, weather effects, as well as many other factors cannot be predicted at this time. The basic guidelines used to predict the degree of defoliation include evaluation of the past defoliation history of the area in question, number of egg masses/acre, size and condition of the egg masses, available preferred food, terrain and risk of larval blow-in following egg hatch. Potential defoliation is categorized as follows: light (1-30 percent); moderate (31-60 percent); and heavy/severe (61-100 percent).

The survey results indicate that gypsy moth populations are sufficiently high to cause moderate to heavy defoliation (31-100 percent) at the Naval Observatory and in western portions of the Naval Surface Weapons Center (White Oak). Localized light to moderate defoliation (1-60 percent) is possible at D.W. Taylor Naval Ship Research and Development Center (Carderock). Scattered light defoliation could occur on the U.S. Naval Reservation at Annapolis.

Three management options have been evaluated for managing gypsy moth populations at any or all of these Navy activities. These options are offered based upon the following objectives: 1) protecting host tree foliage; 2) preventing tree mortality; and, 3) reducing gypsy moth populations. Each is discussed below.

No Action Option

It is possible that gypsy moth populations could collapse of their own accord due to the presence of NPV (nucleopolyhedrosis virus). However, it is not possible to accurately assess the likelihood of such an event with the information on hand. In areas with defoliating level gypsy moth populations (greater than 250 egg masses per acre) viral epizootics generally manifest themselves after significant tree defoliation has already occurred. In areas where defoliation occurs, but where the trees do not need to refoliate, there probably is not any significant impact on the trees. At worst, there may be a reduction in the rate of growth during that season. However, in areas that are heavily defoliated, and where the trees must expend valuable energy resources to refoliate, the stage is set for significant impacts (branch dieback and mortality) depending upon tree condition at the time of defoliation.

Trees at greatest risk are those that are presently stressed from other factors, such as: 1) soil compaction from sidewalks, parking lots, machinery and/or heavy foot travel; 2) over maturity; 3) drought; 4) shock due to recent harvest exposures; and 5) other insect or disease related problems.

Chemical Insecticide Option

The second option is to use a chemical insecticide to control gypsy moth populations. Dimilin^{R} (diflubenzuron) is the most widely used chemical insecticide in State-supported gypsy moth suppression projects in the Northeast. Diflubenzuron is an insect growth regulator that disrupts the normal molting processes of immature larvae. The mode of action is to inhibit the formation of chitin, a necessary component of the outer cuticle which causes the affected larvae to die during the molt following treatment. The method of uptake is primarily by ingestion, however, recent research has indicated the possibility of absorption through the cuticle as well.

Dimilin^{R} is registered by EPA for use in residential areas. It is, however, extremely toxic to aquatic invertebrates, and should not be applied to water or wetlands. Dimilin^{R} is available as a 25 percent wettable powder formulation, and the recommended application rate is 1-4 ounces per acre applied in one treatment. With proper application, foliage protection and population reduction of about 95 percent can be expected.

Microbial Insecticide Option

The third option is to use a microbial insecticide to manage gypsy moth populations. The only biological insecticide currently available for gypsy moth control is a microbial insecticide based on the bacterium Bacillus thuringiensis variety kurstaki. This insecticide is available by a variety of manufacturers and has been used extensively in State-sponsored suppression projects throughout the Northeast in both forested and residential areas. B.t. acts specifically against lepidopterous larvae as a stomach poison and therefore must be ingested. The major mode of action is by mid-gut paralysis which occurs soon after feeding. This results in a cessation of feeding, and death by starvation.

B.t. formulations are available as flowable concentrates, wettable powders, and emulsifiable suspensions. The normal application rates range from 12-20 BIUs per acre in each of 1 or more treatments. With proper application, foliage protection and population reductions of about 70 percent can be expected for each application.

Alternatives

With the previously described options in mind, the following 7 alternatives have been developed.

Alternative 1. -- No action.

Alternative 2. -- Single application of Dimilin^{R} applied aerially at the rate of 2 ounces (formulated material) in 128 ounces of water per acre.

Alternative 3. -- Ground application of Dimilin[R] at the same rate as that discussed in Alternative 1, but diluted such that the total mixture applied provides adequate coverage of the foliage without excessive runoff.

Alternative 4. -- A single aerial application of B.t. applied at the rate of 12-20 BIUs per acre in 1.0 gallons per acre total mix. An appropriate spreader/sticker should be added at the rate of 2 percent by volume.

Alternative 5. -- Two aerial applications of B.t. at the same rate as that discussed in Alternative 4. The second application should be appliled 7-10 days following the first.

Alternative 6. -- Ground application of B.t. at the same rate as that in Alternatives 4 and 5, but diluted such that the total amount applied provides adequate coverage of tree foliage without excessive runoff.

Alternative 7. -- Same as Alternative 6, except two applications are made; the second 7-10 days following the first.

RECOMMENDATIONS BY SITE

Naval Observatory

Although the majority of the gypsy moth infestation at the Naval Observatory was detected in Forest Compartment 3, wind-blown larvae from adjacent areas could disperse throughout the Observatory grounds. Gypsy moth populations on site are high enough to cause moderate to heavy defoliation this spring. As a result some direct action will need to be taken in order to protect tree foliage and reduce gypsy moth populations. The most effective alternative to implement under these conditons is:

Alternative 2 or Alternative 5.

To a lessor degree, the following alternatives may provide varying degrees of effectiveness: Alternatives 4, 3, 6, and 7.

The USDI National Park Service tentatively plans to treat several of their properties for the control of gypsy moth in 1988, one area of which is adjacent to the Naval Observatory. The treatment proposal consists of 1 to 2 applications of B.t. to be applied aerially at the rate of 12-20 Billion International Units (BIUs). If appropriate, it would be logistically advantageous to incorporate the Naval Observatory in the treatment area planned by the USDI National Park Service.

Naval Surface Weapons Center (White Oak)

Gypsy moth egg mass counts indicate that moderate to heavy defoliation could occur in the western portion of this facility. Gypsy moth populations adjacent to the site are such that the Maryland Department of Agriculture (MDA) plans to treat the Hillandale residential and recreational areas. Given this situation, the most effective alternative to implement is:

Alternative 2, 4, or 5.

The remaining alternatives will provide lessor degrees of effectiveness.

Since MDA plans to treat areas adjacent to the Center with B.t., it would be advantageous to contact them and investigate the possibility of including the western portion of the Surface Weapons Center in their spray block.

David W. Taylor Naval Ship Research and Development Center (Carderock)

The survey data indicates that scattered light to moderate defoliation could occur at D.W. Taylor Ship Research and Development Center (Carderock) in 1988. The largest number of egg masses detected were on several trees near the front gate (Plot 9). If defoliation of these trees is unacceptable the most effective alternative to implement is:

Alternative 6 or 7.

Aerial application may not be practical unless arrangements can be made with an applicator already working in the area.

U.S. Naval Reservation (Annapolis)

Overall, the survey results suggest that little, if any, defoliation should occur in 1988 with the possible exception of one site. Here, a single chestnut oak tree in the parking lot of the Post Exchange was found to have 16 egg masses. These can be removed by scraping or the tree could be treated from the ground with B.t. Our recommendation for this Navy activity is to take no action, i.e. implement Alternative 1.

Table 1.--1987 Gypsy Moth Egg Mass Survey Results by Forest Compartment Number. U.S. Naval Observatory, September 17, 1987.

Forest Compartment	Survey Type	Egg Masses/Acre (Average)
1	Timed Walk (3)	62
2	Timed Walk (2)	0
3	1/40 Acre Plot (3)	773
4	Timed Walk (2)	145
5	Timed Walk (2)	55
	Site Average: 207 Egg Masses/Acre	

Table 2.--1987 Gypsy Moth Egg Mass Survey Results by Survey Point Location. White Oak Surface Weapons Center, September 17, 1987.

Survey Point	Survey Type	Egg Masses/Acre (Average)
1	Timed Walk	505
2	Timed Walk	95
3	Timed Walk	35
4	Timed Walk	75
5	Timed Walk	35
6	Timed Walk	0
7	Timed Walk	35
8	Timed Walk	75
9	Timed Walk	115
10	Timed Walk	135
11	Timed Walk	1625
12	Timed Walk	1955
	Site Average:	390 Egg Masses/Acre

Table 3.--1987 Gypsy Moth Egg mass Survey Results at David W. Taylor Naval Ship Research and Development Center - Cardorock, November 23, 1987

Plot Number	Survey Type	Egg Masses/Acre (Average)
1	1/40 Acre Plot	80
2	1/40 Acre Plot	40
3	1/40 Acre Plot	0
4	1/40 Acre Plot	80
5	1/40 Acre Plot	160
6	Timed Walk	240
7	Timed Walk	95
8	Timed Walk	255
9	Timed Walk	815
	Site Average:	196 Egg Masses/Acre

Table 4.--Egg Mass Survey Results of the U.S. Naval Reservation at Annapolis

Plot Number	Survey Type	Egg Masses/Acre (Average)
1	1/40 Acre Plot	80
2	1/40 Acre Plot	0
3	1/40 Acre Plot	0
4	1/40 Acre Plot	40
5	1/40 Acre Plot	0
6	1/40 Acre Plot	0
7	1/40 Acre Plot	0
8	1/40 Acre Plot	0
9	1/40 Acre Plot	0
10	1/40 Acre Plot	160
	Site Average:	28 Egg Masses/Acre

Note: Single chestnut oak in parking lot near Exchange Post had 16 egg masses.

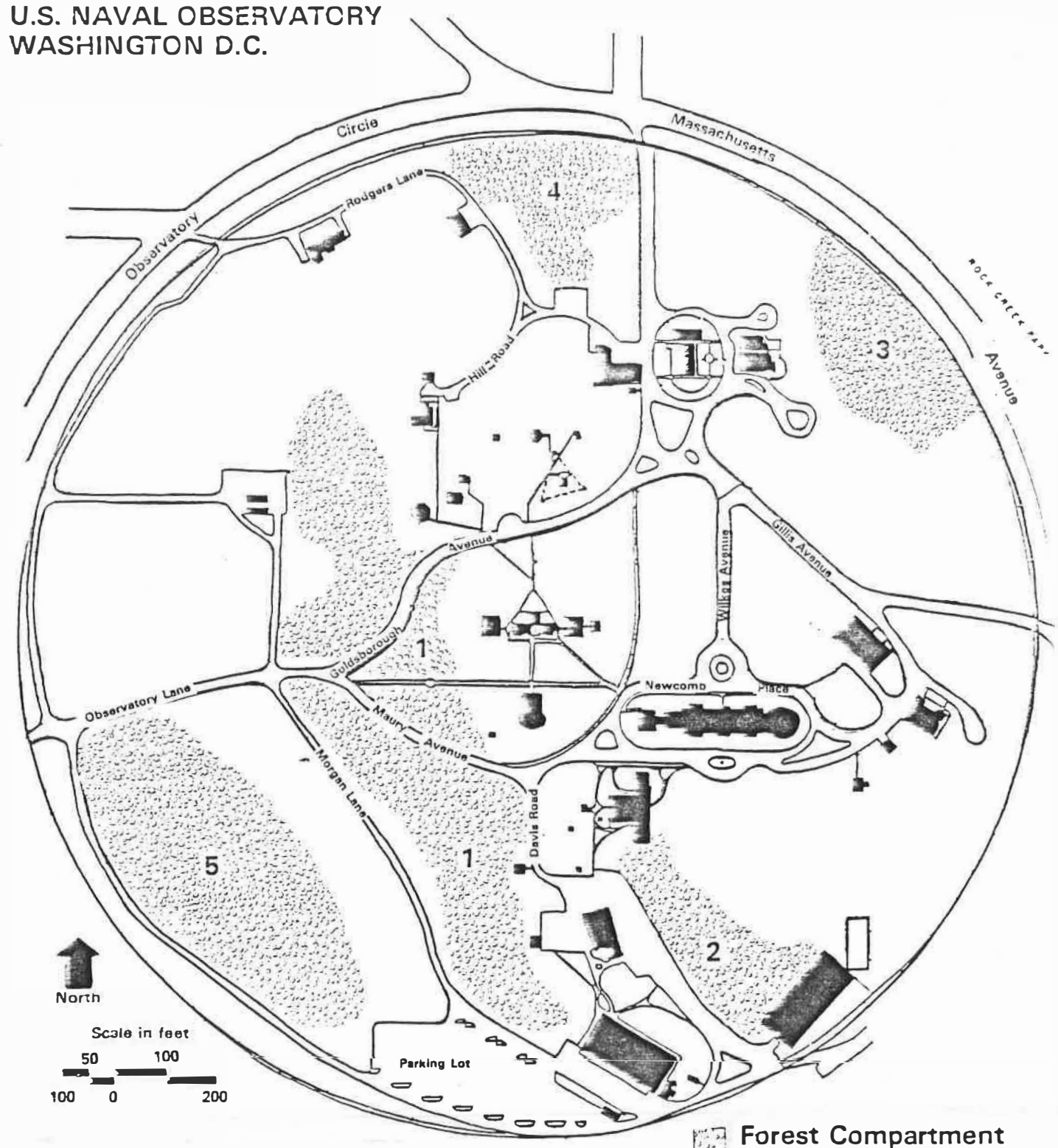
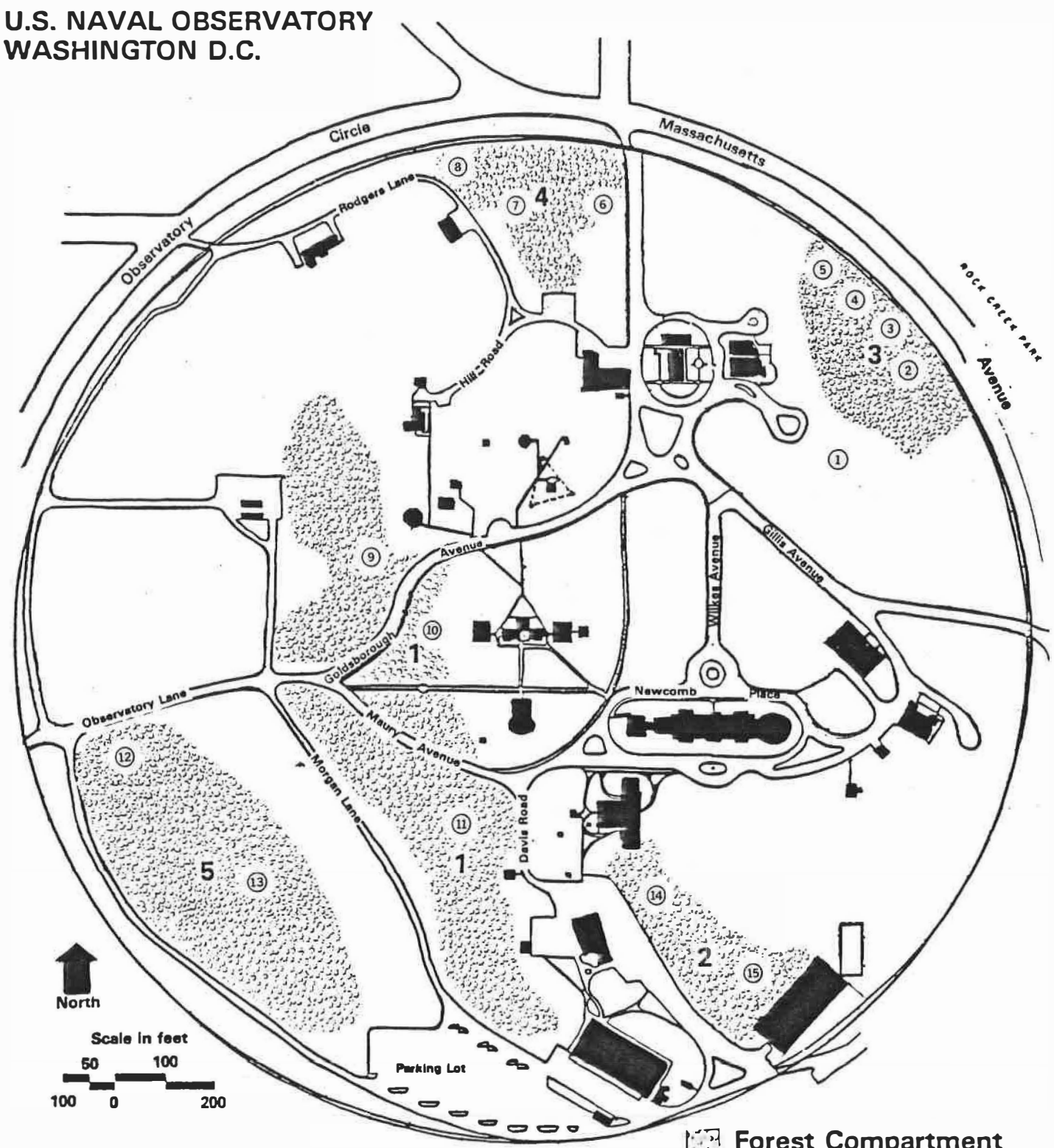


Figure 1.--1987 Gypsy Moth Egg Mass Survey

Figure 1.--Gypsy Moth Egg Mass Survey at the U.S. Naval Observatory, September 13,1988.



Plot Locations=①-⑮

3460

January 8, 1988

Mr. Dwight Fielder
Staff Forester, Code 2432
Naval Facilities Engineering Command
Washington Navy Yard
Washington, DC 20374

Dear Dwight:

Enclosed for your information are the results of our gypsy moth biological evaluations conducted at the Naval Observatory, White Oak Naval Surface Weapons Center, D.W. Taylor Naval Ship Research and Development Center (Carderock), and the U.S. Naval Reservation (Annapolis). In summary, gypsy moth populations are sufficient to cause moderate-heavy defoliation (31-100 percent) at the Naval Observatory and the western portion of the White Oak Naval Surface Weapons Center. With the exception of some isolated trees, we do not anticipate more than light defoliation (1-30 percent) at D.W. Taylor or the U.S. Naval Reservation (Annapolis).

Although I am not aware of your specific gypsy moth management objectives at any of these facilities, I have presented some treatment options and alternatives based on the following management objectives: 1) protecting host tree foliage; 2) preventing tree mortality; and 3) reducing gypsy moth populations. In the report, we recommend aerial application of B.t. or Dimilin at the White Oak facility and the Naval Observatory. Other land management agencies will be conducting gypsy moth suppression projects adjacent to these sites in 1988. It would be more efficient and just as effective if you could convince these agencies to include your proposed treatments in their plans.

Please feel free to call Brad or me if you have any questions regarding the survey results or possible management options. We would also be happy to work with you and these other agencies to accommodate your treatment plans.

Sincerely,

NOEL F. SCHNEEBERGER
Entomologist
Forest Pest Management

cc: AO

NFS/BPO/gjh